

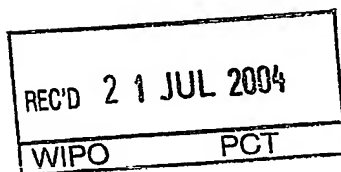


PCT/GB 2004 / 0 0 2 8 9 0



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ



BEST AVAILABLE COPY

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed

Stephen Hordley

Dated

13 July 2004

**PRIORITY
DOCUMENT**

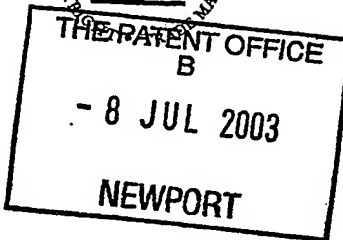
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)



08JUL03 0921007-1 C26047
P0147700 0-00-0315941-5

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference 0300180

2. Patent application number 0315941.5
(The Patent Office will fill in this part) 8 JUL 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

SMITHS GROUP PLC
765 FINCHLEY ROAD
LONDON
NW11 8DS

Patents ADP number (if you know it) 8032310001 ✓

If the applicant is a corporate body, give the country/state of its incorporation GB

4. Title of the invention LOCKING MECHANISMS

5. Name of your agent (if you have one) J. M. FLINT

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode) 765 FINCHLEY ROAD
LONDON
NW11 8DS

Patents ADP number (if you know it) 1063304001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country	Priority application number (if you know it)	Date of filing (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)

Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form


Description

6

Claim(s)

Abstract

Drawing(s)

2 + 2 

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application

Signature



Date 7 July 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

J.M. FLINT

020 8457 8220

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

LOCKING MECHANISMS

This invention relates to locking mechanisms.

The invention is more particularly, but not exclusively, concerned with mechanisms for locking aircraft landing gear in their retracted position.

Aircraft landing gear and doors are held up by means of a pivoted hook mounted within the undercarriage bay and arranged to engage a capture pin on the landing gear or doors. A lock holds the hook in the engaged position. Conventional uplock mechanisms have an hydraulic actuator that releases the lock and allows the hook to rotate out of engagement with the pin when the landing gear is to be lowered. In the event the hydraulic actuator fails, the pilot can release the lock by pulling a lever connected to one end of a cable connected to the lock. This provides a secondary, emergency release mechanism.

In large aircraft it can be very difficult to provide a mechanical interconnection between the flight deck and the landing gear bay, because of the distances involved.

It is an object of the present invention to provide alternative locking mechanisms.

According to one aspect of the present invention there is provided a locking mechanism for engaging and retaining a movable member, the apparatus including a hook member mounted for angular displacement about a first axis such that the hook member can move into and out of retaining engagement with the movable member, a latch member

mounted for angular displacement about a second axis parallel with the first axis, the latch member having a portion thereof spaced from the second axis that can be located to prevent movement of the hook member out of retaining engagement, first and second actuator means operable to rotate the latch member about the second axis such that the portion is moved to a position where it does not prevent movement of the hook member out of retaining engagement, the second actuator means being a rotary actuator and including a cam arranged for rotation about a third axis parallel to the second axis and located to engage a part of the latch member.

The first actuator means preferably includes a solenoid and the second actuator means preferably includes an electric motor. The apparatus may include a spring connected with the hook member to urge it out of retaining engagement with the movable member. The spring is preferably connected between the hook member and the locking member so as to urge the portion of the locking member into engagement with the hook member. The hook member preferably has a hook formation on one side of the first axis and is engaged by the portion of the latch member on an opposite side of the first axis. The portion of the latch member is preferably a roller.

An aircraft undercarriage locking mechanism will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a side elevation view of the mechanism; and

Figure 2 is a perspective view of a part of the locking mechanism.

The locking mechanism, or uplock, is mounted within the landing gear bay of an aircraft and, in the position shown in Figure 1, is locked onto a capture pin 1 attached to the aircraft landing gear or to the landing gear doors. The mechanism is arranged to hold the landing gear and doors in the retracted, up, position until released.

The mechanism has a metal mounting plate 2 with an inverted V shape opening 20 at its lower end in which the capture pin 1 is received. The mechanism includes a hook 3 in the form of a generally elongate plate oriented parallel to the mounting plate 2. The hook 3 is mounted on the mounting plate 2 by a bearing 4 approximately midway along the length of the hook, so that it can be angularly displaced about an axis 5 normal to the mounting plate. The lower end 30 of the hook 3 has a slot 31 open on the right-hand side of the hook and shaped to receive the capture pin 1. The slot 31 overlies the opening 20 in the mounting plate 2, with the lower edge 32 of the slot projecting substantially midway across the opening, in the locked position, so that the pin 1 cannot be withdrawn. On the left-hand side, level with the slot 31, the hook 3 is formed with a small, laterally-extending finger 33 having an opening 34 in which is secured one end of a helical spring 35. The spring 35 is tensioned to provide a force urging the hook 3 in a clockwise sense about the axis 5, that is, tending to pull the lower end 30 of the hook to the left away from the opening 20. The upper end 33 of the hook 3 has a contact surface 36 facing to the right and inclined down at an angle α of about 25° to the vertical. Engagement with this surface 36 prevents clockwise rotation of the hook

3.

A latch arm or clevis 40 is mounted towards the upper end of the mounting plate 20 by a bearing 41 for rotation about an axis 42 parallel with the hook rotation axis 5. The latch arm 40 is of generally dog-leg shape having two limbs 43 and 44 extending at right angles to one another with the bearing 41 located at the juncture between the limbs. One limb 43 extends to the right and down beneath the upper end 33 of the hook 3, at an angle β to the horizontal slightly less than the angle α . At its free end, the limb 43 carries a roller 45 on its rearwardly facing surface. The roller 45 locates to the right of and adjacent the contact surface 36 of the hook 3. In the position shown in Figure 1, the roller 45 limits the extent of clockwise rotation of the hook 3 and prevents it being rotated sufficiently to enable the capture pin 1 to be withdrawn from the opening 20. The geometry of the angle α of the contact surface 36 and the angle β of the limb 43 are such as to ensure that force applied by the contact surface to the roller 45 only tends to rotate the limb 43 further clockwise into engagement with the hook.

The other limb 44 of the latch arm 40 extends generally down and to the left and is bent at its lower end towards the hook 3. An aperture 46 at the end of the limb 44 retains the upper end of the spring 35 so that the spring exerts a force on the latch arm 40 tending to rotate it clockwise.

The latch arm 40 also has a small lateral extension 47 from its upper edge in the region of the bearing 41. A linear solenoid actuator 50 fixed with the mounting plate 2 has a plunger 51 connected to this extension 47. The natural, rest position of the actuator plunger 51 is extended, as shown, with the latch arm 40 in its locked, clockwise position. When the actuator 50 is energized, its plunger 51 is pulled in causing the latch arm 40 to rotate about

the axis 42 in an anticlockwise sense and against the action of the spring 35. When the actuator 50 is fully retracted, the latch arm 40 is rotated sufficiently to lift the roller 45 clear of the upper end 33 of the hook 3. The hook 3 is now free to be rotated clockwise by the spring 35 out of retaining engagement with the capture pin 1 so that this can be withdrawn from the opening 20. In this position, therefore, the mechanism is unlocked.

A microswitch or similar sensor 55 is secured with the mounting plate 20 adjacent the left-hand side of the lower limb 44 so that the switch is engaged by this limb when the latch arm 40 is in its locking position. When the latch arm 40 is rotated anticlockwise to release the hook 3, the limb 44 disengages the switch 55 and causes its output to change, thereby giving an output indication to the pilot that the locking mechanism has been released.

The locking mechanism includes an additional actuator 60 for use in the event of a failure of the main actuator 50.

The additional actuator 60 is most clearly seen in Figure 2. This takes the form of a rotary electric actuator having a motor 61 with an output shaft 62 extending parallel to the axes 5 and 42. The shaft 62 supports a radially-extending cam plate 63 having a peripheral cam surface 64 around its circumference. The cam plate 63 is located behind the hook 3 and contacts the edge of the roller 45 when the latch arm 40 is in its locked state. It will be appreciated that the cam plate 63 does not in any way impede unlocking, anticlockwise rotation of the latch arm 40. In its normal, unactuated state, the rotary actuator 60 has its cam plate 63 oriented such that the shortest radial distance of the cam surface 64 is presented to the roller 45. This thereby ensures that, the latch arm 40 can be rotated fully into locking.

engagement with the hook 3. If, however, the main actuator 50 were to fail, the pilot would actuate the auxiliary actuator 60 by supplying power to rotate the motor 61 and hence the cam plate 63 in an anticlockwise direction. As the plate 63 rotates there is a gradual increase in the radial distance between the cam axis and the part of the cam surface 64 contacting the roller 45. This pushes the roller 45 up, rotating the latch arm 40 anticlockwise until, when fully rotated, the arm has been displaced sufficiently to clear the upper end 33 of the hook 3 and allow it to rotate clockwise. This releases the capture pin 1 and allows the landing gear to extend.

The rotary cam actuator enables a relatively high force to be applied by a relatively compact, simple arrangement. This provides a reliable mechanism without excessive bulk and weight.

It will be appreciated that although the present invention is particularly suited to an aircraft landing gear uplock it could also be used in other applications.

The invention could be modified in various ways. For example, the main, linear actuator need not be an electrical solenoid actuator but could be an hydraulic actuator.

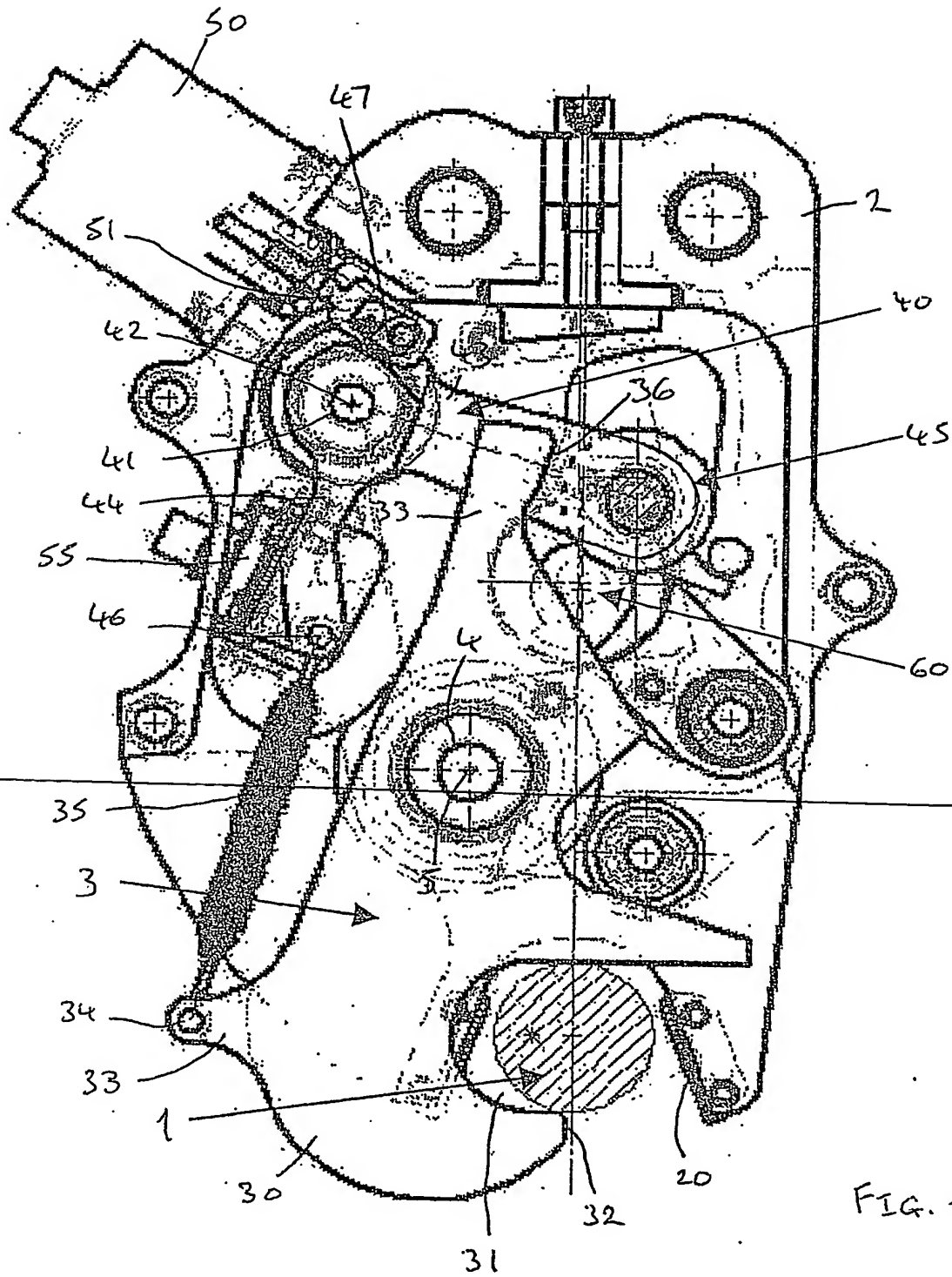


FIG. 1

2/2

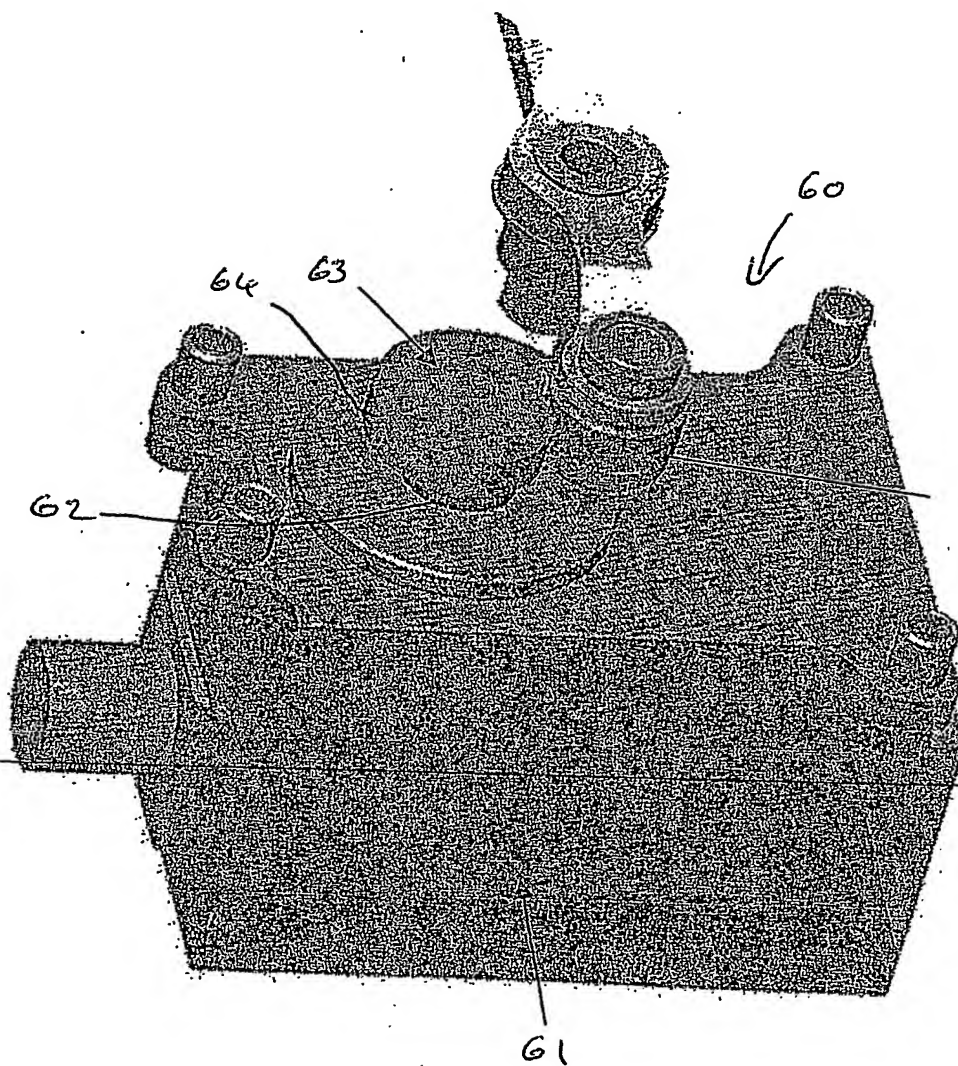


FIG. 2

PCT/GB2004/002890



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.